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Worldwide Report

ENVIRONMENTAL QUALITY

No. 275

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CHRISTCHURCH POLLUTION LEVELS HIGHEST IN 6 YEARS

Christchurch THE PRESS in English 4 Sep 80 p 4

[Text]

Pollution levels have been higher in Christchurch this winter than they have been for six years.

Smoke levels have increased the most, exceeding the World Health Organisation's goal of 120 micrograms per cubic metre 35 times this year.

The recommendation is that no more than seven days in a year should exceed that limit.

Sulphur dioxide levels were much the same as last year, but nitrogen oxides showed increases in most areas.

Increases in pollution levels were greatest in the outer suburbs. At Avonside the W.H.O. goal was exceeded 35 times compared with 21 times in 1979. In August a peak of 239 micrograms per cubic metre was recorded there.

Nitrogen oxide levels were highest in Manchester Street. They exceeded the recommended high of 200 micrograms per cubic metre six times in August. The peak was 248 micrograms per cubic metre.

Despite the high level of pollution the peak levels for all pollutants were lower than they were this time last year. Monthly averages were much the same.

CSO: 5000

STEP UP WORK OF PROTECTING NATURAL RESOURCES

Beijing GUANGMING RIBAO in Chinese 5 Sep 80 p 1

[Article by Ma Shijun [7456 0013 7486], chairman of the Board of Directors, China Society of Ecology; Zheng Zuoxin [6774 0155 2450], vice chairman of the Board of Directors, China Society of Zoology; Yang Hanxi [7122 0698 3556], secretary of the Standing Committee, People's Republic of China Renyu Shenguri quan, Zhang Shuzhong [1728 2885 0022] vice chairman of the Board of Directors, China Society of Ecology]

[Text] Editor's Note: The suggestions of the four comrades Ma Shijun et al are very good. We do not have a scientific attitude with respect to the development and utilization of natural resources, and we have adopted many mistaken methods that have destroyed the ecological balance and created many serious results. How to stop quickly those developments that are destructive to natural resources, how to utilize natural resources reasonably, and how to improve the natural environment to allow it to provide greater and more sustained benefits for the well-being of posterity are extremely important and urgent subjects. It is hoped that the attention of leaders of all ranks and the entire society will be aroused.

China's land area is great and her material resources are rich, but deficient ideological understanding and an inferior system of management have caused serious destruction of natural resources. The consumption of forest resources is 200 million cubic meters per year, and one-third of that is due to abuse and fire. The acreage of usable grassland is 3.3 billion mu, but more than 1,7 billion mu of that have suffered from desertification, degeneration, and salinization, and the yield of grass has been more than halved. Every year the loss of meat due to insufficient fattening and to the death of animals as a result of unavailability of hay in the winter and spring grazing regions far exceeds the total quantity of the state's purchases. In the 1970's, the natural catch of freshwater fish every year was not half that in the 1950's. The area of soil loss due to erosion amounts to 1.5 million square kilometers, the equivalent of one-sixth of the total acreage of the nation. Each year, 6 million mu of fine fields are being eroded by the Huanghe and Changjiang alone. Species that have become extinct or basically extinct since liberation include nearly 10 animals of Equus przewalskii, Saiga tatarica, red-colored Threskiornis aethiopica melanocephala, etc.; another 20 species of animals, including Hylobates hoolock, slope deer, Lipotes vexillifer, etc., are close to extinction. In addition, the destruction of water and mineral resources is rather frightening. In a word, there is a serious maladjustment between the utilization and consumption of resources and the protection and management of resources.

The natural environment is an organic entity in which all elements are interconnected. There is mutual control and mutual transformation. Linkage and transformation proceed according to definite natural regularities (mainly ecological principles) and are not changeable by the will of man. For example, if forests of the upper reaches of a water source are abusively logged to obtain lumber, the riverbed of the lower reaches will rise due to erosion and silting, and flooding will occur. Moreover, some forest animals will become extinct. Examples of this are too numerous to list one by one. For this reason, protection of the natural environment must be carried out through overall consideration and planning. The reality of today's China is the fact that the natural environment as an entity has been cut up and broken to pieces. The various departments of production and the various localities need resources, and they proceed [to get them] from the viewpoint of the benefit to each of them. The emphasis is often on utilization at the expense of protection, and on development at the expense of management. Each takes for its own use, and each extracts what it needs.

There is only the localized viewpoint of momentary gain, and no attention is given to the long-term interest of the whole. Consequently, there have been great reductions of many important resources. The natural environment is being severely destroyed. This situation has already brought, and will continue to bring, great losses to industrial and agricultural production. With the continued development of productivity, the needs for natural resources will increase very fast. Strengthening the work of protecting the natural environment is therefore presently an urgent as well as important task. We offer the following opinions:

(1) The central and various other departments of planning and the various departments of production must formulate regulations and plans that are practicable in order to protect, renew, and utilize reasonably the available natural resources, with the departments of environmental protection participating in the enactment of these regulations and plans.

(2) While proceeding with development of resources, and large-scale engineering construction projects, the work of assessing and forecasting their environmental impact and their efforts on the ecological system must be carried out, and corresponding measures must be adopted to repair the possible damage to the natural environment.

(3) On the basis of authority at the level of the State Council, a Chinese People's Republic Environmental and Natural Resources Protection Committee should be established to set forth as quickly as possible rules for the management of natural preserves, to increase the number of natural preserves, and to strengthen the management of natural preserves.

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CSO: 5000

ENVIRONMENTAL, GEOLOGICAL PROBLEMS OF URBAN WATER SUPPLIES

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 1, 1980 pp 4-5, 35

[Article by Environmental Hydrology Group, Institute of Hydrological Research, Ministry of Geology: "The Environmental and Geological Problems of Municipal Water Supplies in China"]

[Text] Ground water has gradually become the important source of water for China's cities, especially in the arid and semi-arid regions of the north where surface water is relatively deficient and ground water is the major source of water supply for some cities. With the development of industrial and agricultural production, water use has increased rapidly, while concentrated excessive drawing and unreasonable utilization as well as random discharge of the three industrial wastes have caused an obvious reduction of ground water and a deterioration of its quality. If it can be said that in the past the direction of development of hydrology was mainly to locate and assess ground water resources, then today it is mainly to preserve ground water to prevent its total depreciation and pollution. This has become one of the brand-new subjects of modern hydrology and one of the aspects of environmental protection.

I. Environmental Hydrological Characteristics of China's Major Cities

According to preliminary statistics, the ground water supplies of 11 cities of Beijing, Shenyang, Tianjin, Baotou, Xi'an, Huhehaote, Taiyuan, Wulumuqi, Kunming, Jinan, and Harbin amount to 8.36 million tons per day. Aside from the above, cities depending upon ground water as the major source of water supply also include Shijizhuang, Yinchuan, Anshan, Jinzhou, Liaoyang, Fouxin, Baoding, Zhangjiakou, Xuzhou, Changzhou, Qingjiang, Baoji, Lasa, etc and cities depending upon a joint supply of ground water and surface water include Shanghai, Nanjing, Xining, Zhengzhou, Wuxi, Nantong, Yangzhou, Suzhou, etc.

Based upon the environmental hydrological condition of these cities, they may be generally divided into the following types:

The first type: In cities that are located on a proluvial plain in front of a mountain, the major aquifer is the sand, pebble, and conglomerate stratum buried in the frontal proluvial fans. This ground water is generally supplemented directly by surface water, atmospheric precipitation, and crevice water of the mountain region. Its dynamics vary a great deal with the effects of weather. The slope is great so as to cause the water flow to be rapid and the quantity rich. The natural self-cleansing ability of this water is strong. The clay cover of the aquifer is relatively thin, however. Many water-containing layers are directly exposed, with poor natural protection. The ground surface industrial wastewater discharge seeps underground very easily to pollute the ground water.

Toward the lower reaches, after a gradual transition, the area turns into an alluvial plain. The grains of the aquifer turn from coarse to fine. In localized places, the number of clay layers is increased and they are changed from thin to thick. Subterranean water has become load bearing water. The flow speed gradually becomes slow and the self-cleansing ability is weakened. The clay cover is thickened and the condition of natural protection improves. Cities of these areas must pay special attention to treatment of surface wastewater and the problem of preventing pollution of ground water. Beijing, Shenyang, Baotou, Huhehaote, Shijiazhuang belong to this type.

The second type: The aquifer of cities located on river terraces or intermontane river basins is generally distributed in banks of rivers and within the scope of flood plains and terraces and is composed of alluvial sand and gravel. The distribution is stable. Sometimes, the clay layer divides it into two or more than three water-containing groups. The first group is shallow water. Below that, it is load-bearing water, with an abundant quantity. The ground water has a close hydraulic link with the surface water, and is intersupplemented under various conditions. Pollution of surface water will also cause pollution of ground water. Such is the condition in Nanjing, Wuhan, Chongqing, Lanzhou, Xi'an, Yinchuan, Zhengzhou, Jinlin, Harbin, etc.

The third type: The aquifer of cities located on riverbanks, estuaries, and deltas is mostly an interchange of the sea and the land, composed of loose layer of coarse and fine sand. The layers are clearly divided and there are often several layers of water-containing groups. Usually, the shallow aquifer is saline water. In deep layers, the quality of the ground water is better. On the top, there is a clay cover and in between the various groups there are also complete interlayers of separation. Aside from the subterranean layer, the quality of the water of the pressure-bearing layers is generally good. The condition of natural protection is good so that the water of the deep layers is not easily polluted, but the interlayers that are artificially destroyed will also cause pollution.

Mining of water excessively in these areas will cause the subsiding of ground surface and ingression of seawater to affect the ground water quality. Cities of these problems are Shanghai, Tianjin, Talian, Qingdao, etc.

The fourth type: The aquifer of cities of karst regions is water of limestone melt crevices. The quality of the water is good and the quantity is rich. In the south, the three industrial wastes of many cities are discharged through sink-holes, vertical wells, karst fissures, karst caves, etc, and through various types of melt tunnels, they enter subterranean streams to pollute the ground water, which may also converge with surface waters to cause mutual contamination. Some cities of the upper reach discharge pollutants, the fruits of which are eaten by the lower reaches. This type of cities includes Liuzhou, Guilin, Nanning of the south. In the north, karst is mostly buried underground, including Baotuoquan [Baotuo Spring] of Jinan, Jinciquan of Taiyuan, and Benqihu of Benqi, etc.

The fifth type: Inland cities located in the desert and the Gobi belong to this type. The aquifer of the inland river valleys is the Gobi conglomerate stratum, depending mainly upon atmospheric precipitation and the snow melt of glaciers of nearby mountains for supplement. Evaporation is great, mineralization is high, and the quantity is deficient. In segments it is often exposed near the surface. There is no good separating layer from the ground surface, and if it is contaminated, the result may be extremely serious. Such is the case in Wulumuqi [Urumchi] City.

II. The Environmental Geology Problem of Urban Water Supplies

China's ground water resources are very rich, but due to poor hydrological conditions, the condition of submergence, the principle of distribution and supplement, the conditions of flow and discharge vary a great deal; therefore, the quantity of mining and reserve is different. At present, however, the actual quantity of mining in many places is in fact greater than the estimated ground water reserve, and a series of problems, such as prolonged reduction of ground water table, subsidence of ground surface, and pollution, have occurred to cause the protection of ground water resources a problem requiring extremely urgent solutions.

(1) Problem of continuous reduction of ground water table: At present, continuous reduction of ground water table has become a general problem of China's urban water supplies. Even if hydrological conditions are relatively good, the continuous drop of the ground water table remains an obvious situation. For example, the water supply of Beijing belongs to the subterranean water of the conglomerate of Yongdinghe proluvial fan and load bearing water. The ground water reserve of the entire urban

region is about 600 million tons per year. At present, 750 million tons per year are being mined to cause the ground water table to continue to drop at a speed of 1 to 1.5 meters per year. Shenyang City is also one of relatively rich ground water. The surveyed quantity of reserve is 800,000 tons per day, and the current mining quantity has reached 1.5 million tons per day to cause the 20 some sources of water of the city to become all downward leaking funnels, which gradually expand to become one linked entity. Some of these funnels are continuously expanding at a rate of 6.83 km^2 per year. The fourth water-containing group of Tianjin City is centered at Baimiao District, where the water table drops an average of 4.4 meters per year. The water table of such cities as Xi'an, Taiyuan, Baotou, Changzhou, etc is all reducing in various degrees.

Due to the rapid recession of ground water table, a series of bad effects have occurred. The first is the need of new water extracting equipment to cause an economic loss. The second is the fact that reduction of water table has reduced the thickness of the aquifer to cause the quantity of water of individual wells to drop. The third is the fact that due to a drop of the water level, many units drill deep wells and the phenomenon of competing for water between the industries and the farms has appeared to affect the alliance of workers and farmers. Furthermore, the reduction of the ground water table has changed the hydraulic condition to cause an expansion of the leaking funnels and an increase of the area of the sources of pollution. Problems of serious contamination of ground water and local drying out of the ground water, etc have thus occurred.

(2) Subsidence of ground surface: Due to excessive mining of ground water, the ground surface sinks. The problem of ground subsidence is a problem known to all in Shanghai City. At present, the problem of ground surface subsidence is becoming more serious every day in such cities as Tianjin, Xi'an, etc. The maximum subsidence in Tianjin City since 1959 has reached 1.5 meters, and subsidence continues at a rate of 100 millimeters per year. In Xi'an, the rate of ground surface subsidence has a tendency of accelerating: 54 millimeters in 1959-1972 averaging 4 millimeters per year; 72 millimeters in 1972-1976 averaging 18 millimeters per year; and 20 millimeters in 1977-1978. The scope of ground subsidence is identical with that of load-bearing water mining while the quantity of ground water mining has the tendency of being identical with the quantity of subsidence. Judging from the situation in Tianjin and Xi'an, due to excessive mining of ground water, the water table has dropped in a large scale to cause the air-saturated zone of soil layer to deform under osmotic pressure solidification and the water-containing sand layer to become dense under pressure. It is therefore reasonable that the resultant subsidence becomes possible.

(3) The problem of ground water contamination: According to statistics of 44 cities, 41 of these cities have now various degrees of ground water contamination, amounting to 93.2 percent. Of these, cities of serious contamination are Beijing, Xi'an, Shenyang, Taiyuan, Baotou, Jinzhou,

Baoding, Changchun, and Jinlin, amounting to 21.9 percent of contaminated cities. Cities of medium-level contamination include the 17 cities of Shanghai, Nanjing, etc, already amounting to 41.5 percent of contaminated cities. Cities of mild contamination are the two cities of Zhangjiakou and Kunming, amounting to 4.9 percent. There remain 31.7 percent of these cities, the ground water of which has been confirmed to be contaminated but detailed data are still lacking; they include 13 cities of Tianjin, Lanzhou, etc. Judging from contaminants, the regular items are mainly phenols, cyan, arsenic, mercury, chromium, and other poisonous substances, hardness, and nitrates. The hardness of the ground water of the urban water supplies has a tendency of increasing by the year. For example, in such cities as Beijing, Shenyang, Xi'an, Baoding, etc, the area above the hardness index is gradually expanding.

The major reasons for pollution of ground water are: (a) Industrial wastewater seeps through streams and ditches to reach underground without treatment. (b) Industrial solid waste and urban sewer are leached by rainwater and oxidized and decomposed by the surface soil layer to become various contaminants to enter the aquifer to contaminate the ground water. (c) The protective zone of the water sources is poor to cause the ground water to be contaminated. (d) Unreasonable irrigation with contaminated water to pollute the quality of the ground water. (e) Human factors cause ground water pollution; they include for example, artificial backup of ground water for irrigation, leakage of well walls, destruction of underground strata of water separation by underground engineering projects, etc. In a word, ground water is deeply buried in the ground. The flow speed is slow. Once it is polluted, it is very difficult to restore its original quality. For this reason, the major principle should be prevention. Effective measures should be adopted for the ground water that is already polluted. First the source of pollution must be isolated to prevent it to expand further. Then, measures of improvement should be gradually adopted according to the concrete condition so as to carry out good city planning and reasonable arrangement of industries. The discharge of pollutants should be strictly managed to prevent seepage. It is possible to lessen, prevent, and stop pollution of ground water.

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BRIEFS

HAN RIVER POLLUTION SURVEY--The Office of Environment (OE) will carry out an intensive survey of environmental pollution in the basin of the Han River by the end of 1982 with an eye to working out a long-term master plan for environmental preservation in the district. A spokesman said the office would use 1,883 million won in domestic funds and 3,600 million won in loans from the Asia Development Bank for the comprehensive survey project, the first ever planned by the government authorities. Technicians and experts from at home and abroad will be employed for the project to determine the exact situation of contamination in each environmental field, including air and water, along the river, the spokesman explained. On the basis of the survey results, the office will work out long-term measures for the prevention of air pollution, the preservation of soil and the river, disposal of industrial waste, and the minimization of noise and vibration, according to the spokesman. The office will also work out long-term master plans for environmental preservation in other major industrial regions throughout the country based on the results of the survey of the Han River district, the spokesman explained. /Text/ /Seoul THE KOREA TIMES in English 5 Oct 80 p 8/

CSO: 5000

BRIEFS

MEASURES TO CONTROL EROSION--President Shehu Shagari has called the attention of the Anambra/Imo Basin Development Authority to the increasing threat of soil erosion, flood and inadequate water supply in rural and urban areas in Imo state. President Shagari has therefore directed the authority to embark on immediate survey of the problems with a view to providing satisfactory solution to them. He gave this advice when he launched the Anambra/Imo Basin Development Authority water scheme at Agbala near Owerri on Tuesday. As a first step in the national development of water resources, the implementation of some identified projects would continue in the next plan period, President Shagari said. Among these projects, he pointed out, were the Idemili flood plain, South of Onitsha, the Niger flood plain, Nyamba irrigation project, upper-middle and lower Imo River projects, erosion controls in Anambra and Imo and the provision training facilities for management personnel and project operation. /Richard Nmaram/ /Excerpt/ /Enugu DAILY STAR in English 4 Sep 80 p 1/

CSO: 5000

SOCIOECONOMIC ASPECTS OF URBAN ECOLOGICAL PROBLEMS ANALYZED

Moscow IZVESTIYA AKADEMII NAUK SSSR. SERIYA EKONOMICHESKAYA in Russian
No 4, Jul-Aug 1980 pp 69-77

[Article by N. A. Tolokontsev and V. S. Visharenko]

[Text] This article analyzes a number of socioeconomic aspects of the ecological situation existing in major cities. Interaction between ecological and technological factors in the conditions of scientific-technical progress are examined. The conception of long-range ecological programs for major cities with a consideration for the regional aspects of urban ecology is presented.

Urban ecological problems have been attracting increasingly greater attention in the last decade. The reason for this is that the environment of the cities, especially the large ones, is being subjected to significant changes due to economic activity.

The UNESCO MAB program includes 112 research topics (13 percent of the total number) devoted to urban ecology; the fact that 30 countries are working on them,* both economically developed and developing countries (for example Pakistan, Papua-New Guinea, Zaire), attests to their importance.

The ecological aspects of urban function and development are highly diverse, which makes it hard to determine what must be studied in terms of urban ecology. Moreover the very concept "urban ecological problems" requires elaboration.

We can distinguish three closely interrelated aspects in this area--ecological (close to the traditional biological interpretation), environmental (having a relationship to the environment), and resources (foreseeing sensible use of natural resources).

*See "MAB Information System Compilation," 4 July 1979, UNESCO.

In our opinion the term "ecological" would be meaningfully applied to a broad class of direct and indirect interrelationships between objects and their immediate surroundings. In this case the problems to be dealt with could be defined more specifically in terms of the space within which these interrelationships exist (for example residential ecology, urban ecology, regional ecology), the dominant object (human ecology, transportation ecology, the ecological problems of the fuel-energy complex), and the dominant process (ecological problems of scientific technical progress, ecological problems of land reclamation, ecological problems of soil degradation). In addition this terminology permits finer definition of the problems under analysis by continuing the subdivisions further. We could narrow down the object of study without divorcing ourselves from the context of the more-general concepts. As an example, despite all of its uniqueness, the problem of human ecology in urban transportation could easily be included in work on more-general problems. Thus in addition to enjoying the possibilities for breaking concepts down extensively, we can still achieve a synthesis of them within the framework of a common problem.

The most significant characteristic of urban ecological problems is that they arise as a rule in response to the interraction of several factors. Thus pollution of some element of the environment does not by itself create an ecological problem. The latter manifests itself only when we examine the action of the polluted environment upon human health or upon material-technical and natural objects--that is, when we examine what happens due to the interraction of different factors.

The importance of studying ecological problems in urban conditions becomes rather obvious in this connection. It is precisely in the cities that we observe a high concentration of contaminants in different elements of the natural environment, and that we find significant concentrations of people and the largest number of material-technical objects, historical-cultural monuments, industrial products, and other material and cultural valuables subjected to the destructive influence of a polluted environment.

On the other hand the high concentration of environmental pollution sources in the cities creates the conditions for more-competent multiple use of all forms of industrial and domestic wastes, which may significantly raise the effectiveness of ecological measures.

The acuity of urban ecological problems is also intensified by the fact that in addition to growth in anthropogenic pressure upon the environment due to development of industry, transportation and construction, the requirements imposed on the quality of the environment are constantly rising.

The most important unique feature of urban ecological problems is that they involve socioeconomic processes directly and indirectly. This is precisely what explains appearance of the rudiments of feedforward and feedback self-regulatory mechanisms, which have the potential for improving the quality of the environment in the cities. Here are a few examples.

Growth in contamination of the urban environment increases the proportions of the direct economic loss elicited by the higher rate of deterioration of buildings, structures, industrial equipment, transportation, and communications, and by the decrease in quality of industrial products, raw materials, and semifinished products. Moreover as the cost of fixed capital grows, this loss increases, and the economic feasibility of measures aimed at improving the quality of the urban environment constantly rises.

Requirements on the quality of the environment's principal elements--water and air--increase in the course of scientific-technical progress. The unfavorable influence of a polluted atmosphere reveals itself in the most progressive sectors of industrial production, such as electronics, precision machine building, and instrument making, and not so much in production itself (it could be isolated from direct contact with atmospheric air) as in the products created, which lose their qualitative characteristics more quickly. Thus the ecological situation is to some extent becoming an obstacle to further development of scientific-technical progress and to utilization of its achievements in the major cities. This factor can influence the distribution of new production operations and the socioeconomic processes of the cities right now. But of course the most significant consequences should be expected only in the remote future.

Exhaustion of natural resources and growth in the expense of their extraction must inevitably lead to growth of their economization, which would immediately reduce environmental pollution. Thus economization of one kilwatt-hour of electric power would mean not only a savings of about 300 gm of coal, but it would also avert discharge of the pollutants formed through its combustion. Moreover, growth in the cost of raw materials would make a constant increase in the effectiveness with which all forms of wastes are utilized inevitable, as can be seen from the example of the Leningrad experimental plant for multiple use of solid wastes produced by the "Spetstrans" Administration of the Leningrad City Executive Committee.

We can cite many more examples of feedback mechanisms that theoretically promote improvement of the ecological situation in cities. Also included among them are locally operating factors that have an extremely noticeable influence upon urban function and development.

If we are to analyze and predict the condition of the surrounding natural environment of the cities, we would need a developed system of indicators objectively reflecting the ecological situation, and a knowledge of the principal trends in the latter's change. The presently existing systems of environmental quality indicators (PDK's [maximum permissible concentrations], PDU's [maximum permissible levels], PDD's [maximum permissible radiation doses], etc.) regulate certain characteristics of pollution, but it should be considered that these indicators could be effectively used only within enclosed spaces, for example in relation to the air environment of production buildings; in the atmosphere of a major city, on the other hand, which may simultaneously contain hundreds of contaminants, assessment

of its condition on the basis of such PDK's is extremely difficult. It is in this connection that we must find a system of integral indicators to describe the ecological condition of a city.

We feel it possible to distinguish three forms of such indicators, ones characterizing the overall reaction of material-technical objects and biological systems and objects to pollution of the environment, and the health of different population groups. Development of these indicators is in itself a complex problem requiring serious scientific research, but we can already say right now that the first two forms of indicators are rather limited, inasmuch as material objects react mainly to chemical contaminants and some forms of physical influences, while biological systems and objects may react to a broader spectrum of agents, to include noncaustic forms of pollutants, but their reaction is less precise. In turn, human health is doubtlessly the most universal and, at the same time least precise indicator of the ecological condition of the environment. Certain inaccuracies are inherent to each of these indicators, since the principal processes addressed by these indicators--for example rusting of metals, reduction of annual tree growth and, finally, various forms of diseases, may be influenced by relatively "neutral" factors as well, for example air humidity and temperature. This property of integral indicators persuasively demonstrates the need for simultaneously using all three forms of indicators, which mutually supplement and correct one another.

On the whole, analysis of these indicators could permit us to create a single universal scale describing the economic condition of a major city.

Change in the health of urban residents is not only an indicator of the city's ecological conditions but also its most important socioeconomic consequence, which must predetermine the principal directions to be followed in improving the quality of the environment. In this connection it is extremely important to emphasize that the health itself of urban residents is, within the limits of the biological norm, a function of economic, social (including psychological), and ecological conditions.

Many factors influence the health of urban residents as a whole, particularly the typical traits of the urban way of life--hypodynamia, a higher nervous load, commuter fatigue, and a number of others, but the most influential is environmental pollution. Evidence of this can be found in particular in the significant morbidity differences observed in different regions of the same city.

The statements above can be confirmed by data from work by Lashneva,* who studied the morbidity of children residing in two Moscow rayons subjected

*Lashneva, I. P., "Morbidity of Preschool Children Residing in Rayons With Different Levels of Atmospheric Pollution," in "Nekotoryye voprosy gigiyeny rastushchego organizma" [Some Problems in the Hygiene of the Growing Organism], Moscow, 1978, pp 40-48.

in different levels of atmospheric pollution: In one (K-skiy), a large number of industrial enterprises are located near children's nurseries, and in the other (Ch-skiy), the children's institutions are located away from the principal highways and sources of toxic air pollutants. An analysis of morbidity showed that total acute morbidity in K-skiy Rayon was 1.5 times greater than in Ch-skiy Rayon. The incidence of respiratory illness among children of all age groups (from 1 to 6 years) was also 1.5 times higher in K-skiy Rayon than in Ch-skiy Rayon, while the incidence of nervous system and sense organ diseases was 2-2.5 times higher.

The most noticeable negative consequences of environmental pollution in a large city manifest themselves as a worsening of the health of urban residents in comparison with rural residents. Thus for example an in-depth study of the morbidity of individual groups of urban and rural residents conducted by Bednyy et al.* persuasively showed that urban residents suffer neurosis, diseases of the cerebral vessels, diseases of the central nervous system, and respiratory diseases more frequently. Irodova's work** can serve as a clear confirmation of the fact that environmental contamination is precisely the cause of higher morbidity of urban residents. The author compares retrospective data on contamination of the atmosphere by toxic wastes with the dynamics of the population's morbidity and mortality, caused by malignant neoplasms of the respiratory organs, over a 14-year period. The two large cities she compared, A and B, which differed significantly in relation to atmospheric pollution and all other "parameters" (climatic conditions, population size and age structure, the level of medical services, and other socioeconomic factors), were otherwise entirely identical. City A was contaminated to a greater extent by sulfur dioxide, dust, phenol, and benzpyrene. Complaints of worsening sanitary and personal living conditions were noted 2.2 times more frequently in city A than from residents of city B. Respiratory diseases occur 1.9 times more frequently among residents of city A than city B. Lung cancer was encountered twice as frequently (Table 1).

Special mention should also be made of the fact that the average time persons not having contact with harmful factors at work lived in the city prior to developing lung cancer was an average of 30 years for the residents of city A and 41 years in city B. This difference of 11 years is statistically significant ($p < 0.05$).

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* See Bednyy, M. S., et al., "Sotsial'no-gigeyenicheskaya kharakteristika zabolevayemosti gorodskogo i sel'skogo naseleniya" [A Sociohygienic Description of Urban and Rural Morbidity], Moscow, Izd-vo "Meditsina", 1975.
** See Irodova, Ye. V., "The Influence of Industrial Wastes Containing Carcinogenic and Toxic Substances Upon the Spread of Lung Cancer," GIGIYENA I SANITARIYA, No 7, 1974, pp 6-10.

Table 1. Growth in Mortality Due to Lung Cancer and Other Malignant Neoplasms in Cities A and B During the Period of Study (standardized mortality indicators for each city in the first period of research are adopted as 100%) (from Ye. V. Irodova)

Tumor Location	In Relation to Initial Period, %	
	City A	City B
All malignant neoplasms	111	69
All malignant neoplasms except lung cancer	101.2	65.6
Lung cancer	200	105.2

It would be important to note that unfavorable trends in the levels and structure of the morbidity of different population groups significantly aggravate the problem of human ecology in the large city--that is, they intensify the conflict between the need for improving the habitat and the anthropogenic pressure upon it, destruction of the environment. This aggravation is associated with an increase in the significance and "price" of the human factor in the present stage of scientific-technical progress, and it stems from a number of causes. First, reduction of labor resources (in the opinion of most scientists, beginning with the 11th Five-Year Plan the entire increase in national income must be obtained only through an increase in labor productivity). Second, changes in the nature and content of labor, which is transforming more and more into operator labor; this in turn will demand higher nervous and emotional stability from the workers. Third, a high level of general and occupational training and capabilities, and the potential for specialists to transfer quickly to new sectors of the national economy. Fourth, the need for developing new regions of the country characterized, as a rule, by extreme habitation conditions (the subarctic zone, the deserts, high mountains). Obviously all of these factors are quite significantly associated with the good physical and mental health of workers. Without going into detail on the grounds for this premise, let us cite just one example borrowed from research conducted by Dikaya* in the 1972-1973 school year in seven Moscow schools, illustrating the influence of physical health upon the academic success of school children--future labor resources (Table 2).

* Tikiya, A. N., "The Health and Material-Personal Conditions of Outstanding and Failing School Children," in "Sotsial'naya sreda i zdorov'ye podrastayushchego pokoleniya" [The Social Environment and the Health of the Growing Generation], Moscow, USSR Ministry of Public Health, Institute of Child and Adolescent Hygiene," 1974, pp 35-38.

Protecting the health of the public is not cheap. However, the losses caused by poor health are even less cheap. Thus according to Kulagina* the losses in national income resulting from total absences of workers due to illness and pregnancy in just USSR industry alone were (rubles): 4,712,400,000 in 1960, 5,711,400,000 in 1965, 9,311,400,000 in 1970, and 10,264,230,000 in 1973. The ratio of national income unproduced as a result of worker morbidity to the produced national income of industry was about 6 percent each year.

Table 2. Distribution of Failing and Outstanding Schoolchildren in Relation to Health Groups (From A. N. Dikaya)

Group	Oustanding	Failing
1. Healthy children	71.7	47.1
2. "Risk group"--having functional deviations or some morphological alterations, and falling ill frequently	5.8	10.4
3. Children suffering chronic illnesses in a state of compensation	18.5	38.8
4. Children suffering chronic illnesses in a state of decompensation	4.0	3.7

The need for keeping urban residents healthy and efficient intensifies the requirements on environmental quality. First, the number of negatively operating factors rises (for example, toxic substances in the atmosphere and in water basins). Because these factors must be kept under surveillance and their joint influence upon man must be accounted for, the maximum permissible values of each of them must be reduced. Second, the maximum permissible values (PDV's) of many negatively operating factors in the environment (toxic substances, ionizing radiation) that are a function of our knowledge are periodically reviewed, and the requirements are made stiffer as a result of such reviews. Thus for example, the maximum permissible concentration (PDK) of aniline in the air of production buildings has been decreased by a factor of 1,000 between 1930, when its presence was first established, and 1971; the PDK of benzene has been decreased by a factor of 40 during this time.** Our notions of the danger of ionizing radiation

* Kulagina, E. N., "Zdorov'ye i ekonomika" [Health and Economics], Gor'kiy, 1975, p 26.

** Sanotskiy, I. V., and Sidorov, K. I., "The History of Hygienic Standardization in the USSR," GIGIYENA TRUDA I PROFZABOLEVANIYA, No 9, 1973, pp 11-16.

have also changed, and the maximum permissible radiation dose (PDD) (expressed in rads/week) has decreased correspondingly. Thus the PDD was 1.5 in 1924, 1.0 in 1934, 0.3 in 1950, and 0.1 in 1956--that is, it was decreased by a factor of 15.

In general, the health of the population is the most important resource, since the prospects of society's future development depend on the former. The need for preserving and "multiplying" this resource is a most important social and economic task.

At the present stage we cannot rely completely on self-regulation of ecological processes in cities. The fact is that the results of many of them may reveal themselves only after many years, after which it would be too late to regulate anything. Regulation of many ecological processes may be possible only through long-range prediction of the ecological situation. The feedbacks arrived at through such a prediction should be called quasi-regulatory, since they would have only potential regulatory functions that could reveal themselves only after we recognize their action and engage in subsequent purposeful activity. Such relationships are rather widespread in human activity; without them, socioeconomic processes of any complexity would be generally impossible.

If we are to resolve the ecological problems of the cities, we would have to carefully study the quasiregulatory processes associated with socio-ecological interaction such that we could later pin them down through legal standards. Thus for example, we need not adopt laws prohibiting contact with burning objects, inasmuch as the human reaction to such contact is sufficiently fast; obviously, however, we do need laws to limit smoking, since the price paid for it is so remote in time that it has a quasiregulatory nature. Moreover, as experience has shown, in this case the quasi-regulatory dependencies often assume real meaning to the individual only after his health is directly threatened--that is, after the feedback time is sharply reduced.

We feel it totally inadequate to limit the grounds for ecological measures to just economic terms alone, to an assessment of the averted loss, for example, inasmuch as many consequences of presently existing ecological conditions may even remain with us for several generations. In this sense the example of socioeconomic substantiation of programs for education and occupational training may provide an analogy. We could hardly compute the loss inflicted upon society by reduction of educational programs, which is equally true of computing the impact of their expansion. On the other hand it is on the basis of long-range predictions of the country's social and economic development, development of individual sectors and regions, the course of scientific-technical progress, and a number of other factors that we determine, with sufficient dependability, not only the investments that must be made into educational programs but also the structure and priority of these programs.

In our opinion we can solve urban ecological problems only within the framework of long-range integrated ecological programs (KEP's), which should be written in conjunction with long-range programs for improving the health of the urban public. These programs must rest upon long-range predictions of the ecological situation in the city and in the contiguous region, in conjunction with predictions of the state of public health as well as of development of the main sectors of industry, transportation, construction, and agricultural production, with a consideration for the basic trends of scientific-technical progress. It is on the basis of these predictions that we should write the long-range KEP's for the given city and its contiguous region. These programs consist of two major blocks--the urban regional ecology block and the intra-urban ecological problems block, each of which is made up of several subprograms having the purpose of solving key ecological problems within the given city. Such territorial programs need not necessarily have complete technical-economic grounds. What is more important to them is consideration of the prospects of technical and technological development.

In addition to defining the basic goals and tasks of urban ecological planning, KEP's will promote optimization of the distribution of assets earmarked for nature conservation measures, inasmuch as they will not only reduce the degree of their dispersal but will also help concentrate efforts at completing the most important projects.

Within the limits of the long-range KEP's, it would also be suitable to define the alternative ways for improving the ecological situation, and the main directions to be followed by integrated ecological measures within the limits of the city and region. Another of their principal tasks is to coordinate long-range ecological programs with social, economic, and technological programs at both the regional and national level.

The next stage is to determine the priorities of ecological measures and of implementing individual ecological plans. One of the main methods for determining such priorities is ecological mapping of the city. This basically requires analysis and assessment of the real and potential consequences of the influences of a polluted environment upon human health, natural systems, and material-technical objects. Thus presence of large numbers of people on one of two streets suffering identical amounts of atmospheric pollution is an indication of a greater potential ecological hazard existing on that street. Therefore it would be more correct to refer to socioecological mapping.

The overall socioecological map of the city must be based on several source maps: pollution of the water basin, the zones of stable pollution of the air basin (showing the background, point, and linear pollution levels); noise (showing the levels of daytime and night-time noise); the sanitary condition of the region; the condition of green belts (showing territories that could be utilized for their expansion); objects and zones of special attention requiring especially comfortable environmental conditions

(children's institutions, hospitals, polyclinics, athletic fields, historical and cultural monuments, etc.); population density in relation to microdistricts and thoroughfares.

In our opinion it would be suitable to determine the concentrations of pollutants in the atmosphere for ecological mapping by computation. Monitoring data are characterized by too great a scatter as a rule, elicited mainly by meteorological conditions. Moreover the computation method may also provide possibilities for direct and retrospective prediction of the level of contaminants in the air basin. Thus contaminants produced by linear sources can be determined by measuring traffic intensity and expressing their magnitude as unit discharges per transportation unit (these data may also be used to draw up the noise map). Knowing the total size of the city's transportation pool and the average traffic volume, we could compute the proportion of the commuter traffic handled by the given thoroughfare and express it in relation to the total number of motor vehicles. If the traffic volume structure remains constant, we could approximate the growth of traffic this thoroughfare may experience in response to an increase in the size of the transportation pool. This model may be improved upon constantly by considering additional factors--the length of the average run and the technical condition of the motor pool, the average speed, and a number of other factors that would correct the prediction accordingly. This method is especially valuable in that we can estimate the degree of pollution of the city's air basin several decades ago, before environmental quality was placed under surveillance. This is especially important to investigation of urban morbidity caused by environmental pollution.

All data collected together in the source maps must be summarized in the overall socioecological map of the city. This summarization must be based on a single point assessment accounting for the condition of the environment and various effects. The correctness of the point assessments and the coefficients used in summarizing them must be established by special experiments investigating the influence of the environment upon various elements of the urban environment, and mainly human health. The overall point assessment must also be supplemented by zonal coefficients correcting the former in relation to the climatic and geographic conditions of the given zone.

Socioecological mapping based on an overall point assessment can quite definitely establish the priority of different ecological measures in the city. Moreover by decoding and determining the relative weight of the initial components of the overall point assessment for the given urban territory, we can select the most advantageous means for reducing it. In general, creation of socioecological urban maps will improve planning, control, and surveillance over the quality of the environment on a territorial cross section.

The nature and means of solution of urban ecological problems constantly change in time. The principal goals and tasks of ecological planning change in connection with this as well. Thus while eliminating all forms of discharges into the environment is the main one today, we may predict that in the near future, maximum utilization of these discharges may become the dominant task.

We would like to lay special emphasis on the fact that growth in the requirements on environmental quality and the outlays on complying with them are associated by a complex, nonlinear dependence.* The outlays are growing much more quickly than are the requirements upon the environment. This is very important. It follows from this that transition to closed production systems excluding discharge of toxic substances into the environment will be the sole (and apparently the only economically feasible) means for satisfying the growing requirements upon its quality.

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* N'yuell, V. A., "Maximum Permissible Loads Upon Man," in "Vsestoronniy analiz okruzhayushchey prirodnoy sredy" [Comprehensive Analysis of the Surrounding Natural Environment], Leningrad, "Gidrometeoizdat", 1975, pp 121-137.
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ECOLOGICAL PRINCIPLES OF CONSERVING AND UTILIZING NATURAL RESOURCES

Kishinev KOMMUNIST MOLDAVII in Russian No 6, June 1980 pp 82-86

[Article by M. Lupashku, Vice President, Moldavian SSR Academy of Sciences]

[Text] Environmental protection and nature conservation have become a worldwide problem, in the successful solution of which all mankind is vitally interested. The future of our biosphere is now the concern of agricultural specialists, economists, and scientists.

Much attention is being devoted to these problems in our country. Just recently a number of party and state documents regulating environmental protection and utilization of natural resources have been adopted. These issues are broadly reflected in decisions of the 26th CPSU Congress, the USSR Constitution, and the constitutions of the union republics. The activities of all of our organs are aimed, as Comrade L. I. Brezhnev noted at the 25th CPSU Congress, at "insuring a unified, national approach to development of the entire agroindustrial complex," in accordance with the laws of nature utilization.

These requirements have special importance to Moldavia, the most densely populated republic, in which all of the natural landscape has been developed and the agroindustrial complex is rapidly developing. Concentration and specialization of agriculture and its transformation to an industrial basis have significantly intensified the influence upon the natural environment. In the future this influence will increase even more in view of production's intensification. In this connection the problem of protecting the natural environment from pollution and maintenance of the natural rhythms of development of natural processes acquire exceptional significance.

Let us dwell on some ecological issues associated with conservation and utilization of natural resources in our republic. As we know, fertilizers (both organic and chemical) are one of the most powerful factors promoting growth in the productivity of agricultural production. According to the estimates of many scientists about 50 percent of the increase in yields is being achieved in our republic due to the use of fertilizers. They raise the effectiveness of crop rotation, irrigation, soil working, and protection of plants against pests, diseases, and unfavorable weather

conditions, and they create the grounds for fuller utilization of the potentials of agricultural plants.

Great is the role of fertilizers in maintaining and improving soil fertility. While at the beginning of the present century nutrient consumption exceeded replenishment on Moldavian territory, today, owing to increasingly broader use of fertilizers, the balance of these nutrients has changed significantly for the better. According to estimates of the agricultural chemistry department of the Kishinev Agricultural Institute, the mean annual deficit of nitrogen, phosphorus, and potassium (NPK) in our soil was 61 percent in the Eighth Five-Year Plan, while in 3 years of the current five-year plan it is 35 percent. Last year about 1 million tons of just mineral fertilizer alone were introduced into the farmlands of Moldavia. Each year we must introduce 1.5-2 million tons of nutrients in order to maintain a nonnegative balance of basic nutrients in the soil and attain the planned yields.

Despite significant growth in fertilizer use, our soil still experiences an acute shortage of the basic nutrients, especially nitrogen. Its negative balance reduces the quantity of humus, upon which, as we know, the chemical, physical, biological, and other properties of the soil depend. According to the Scientific Research Institute of Soil Science and Agrochemistry imeni N. A. Dimo, each year the republic loses 600-1,500 kilograms of humus from every hectare. Therefore we must do everything we can to prevent the loss of this priceless wealth of our soil, mainly by developing and utilizing more-effective integrated measures to control erosion and cultivate pulse crops more extensively.

As we can see, proper fertilizer use is an important means for improving product quality and increasing crop yields and soil fertility. In many cases fertilizer also plays an environment purifying role. Improving plant development, fertilizer increases their photosynthesizing activity and thus intensifies carbon dioxide absorption.

But fertilizer can also do considerable harm. This happens when it is mishandled, when the rules of its storage, shipment, and use are violated. In this case it becomes a serious source of pollution of the environment (the soil, ground water, and air), which in the end has a negative effect upon the plant and animal world, and upon human health. As a result of fundamental improvements of the agrochemical service in the republic, the losses of mineral fertilizer during shipment and storage have decreased by more than a factor of three in the last 10 or 11 years; however, the losses are still significant: They total about 5.1 percent for 3 years of the current five-year plan. Great also are the losses of organic fertilizer. About 60 percent of the nitrogen contained in an average size feedlot is removed with solid and liquid manure, while about 30 percent enters the soil in the form of nitrates, or undergoes evaporation. Therefore we must do everything we can to insure its proper shipment and storage, which will prevent its entry into the environment.

Compliance with the rules of fertilizer use are no less important. Unfortunately we encounter many cases in practice where fertilizer is used in excessively high doses. As a result a significant proportion of the nutrients it contains, especially nitrates, sulfates, and chlorides, being unassimilated by plants, migrate into ground water, and then into the rivers, polluting them. According to data of the agricultural chemistry department of the Kishinev Agricultural Institute, in 12 years 370 kilograms of nitrate nitrogen are leached out of the main plant root system zone of one hectare of cultivated land, while 809 kilograms are leached away from every hectare of bare fallow. Excessive quantities of fertilizer and its nonuniform distribution in the soil have a deleterious effect upon the plant world, including cultivated plants: They cause their lodging, and they promote their injury by diseases and pests, by drought, by frost, and so on. Systematic application of heightened fertilizer doses reduces soil productivity and the biological value of dietary and feed plant products.

Intensification of agricultural production would be unimaginable without broad use of chemical preparations to control pests, diseases, and weeds of cultivated plants. At the present time every hectare of farmland in the republic is treated with pesticides almost twice a year, while certain crops are treated five to ten times. A hectare of sugar beets, tobacco, grapes, and some vegetables is treated with 30-50 kilograms of such preparations. Hence it is clear how important their correct use is to our republic, with its broken terrain, the torrential nature of summer rain, and the often-repeating droughts. Unsystematic use of chemical plant protection resources may lead to dangerous phenomena such as arisal and mass spread of new pests, diseases, and weeds, disturbance of natural ecosystems, and annihilation of useful fauna, especially natural pollinators.

Therefore the system of measures to control diseases, pests, and weeds must be worked out meticulously and complied with strictly. The agrotechnical method must be its principal element. Science and practice have established that when this method is properly applied, chemical resources are reduced to a minimum. The biological pest control method is already being assimilated and developed in the Moldavian SSR; in the future it is to assume the leading place in the integrated system of plant protection.

Large livestock complexes, the construction and operation of which are sometimes associated with violation of the necessary requirements, are becoming a source of significant pollution of the environment, the soil, and surface and ground water by organic substances.

In order to avert pollution of the environment by animal husbandry complexes and to create normal conditions for animals, we must follow the rules of their construction to the letter. This means, first of all, selecting their location with a consideration for not only presence of a feed base but also a buffer zone (consisting mainly of woody vegetation), the direction of the prevailing winds, the remoteness of population centers, the size of the building, the technology of manure removal, and so on.

Water consumption is quickly growingin connection with concentration, specialization, and intensification of all sectors of the national economy. Estimates show that in just 7 to 10 years the already meager water resources of Moldavia will be sharply reduced. Therefore an acute need is arising for development of effective measures to accumulate, protect, and sensibly use water. This problem is very complex and multifaceted, and its solution requires the efforts of large collectives of scientists and producers.

In particular, we will have to set standards for the concentration of fluorine, hydrogen sulfide, iron, strontium, and nitrates in undergound water; in many regions these concentrations are high, due to which the water fails to satisfy the All-Union State Standards. Many of the country's scientific centers and the republic's scientific research institutions are involved in an integrated program to develop water defluorination methods. One such method, developed by the Moldavian SSR Academy of Sciences Institute of Chemistry, is presently undergoing testing at the Bel'tsy aqueduct and in Ungenskiy Rayon.

We must deal more aggressively with the problem of removing another toxic component from underground water--hydrogen sulfide and its compounds, since water containing them cannot be used for either domestic or industrial purposes. The problem of halting contamination of surface water and underground sources by industrial, domestic, and agricultural effluents deserves the most serious attention. This is exceptionally true of the Dniestr River basin.

In order that nature would develop harmoniously and man would feel his best, man's economic activity must not conflict with the interests of nature. We must always remember that everything is mutually related and mutually dependent in nature, and that when we exploit some element of the biosphere, we must always remember the others.

I believe in this connection that it is not enough to evaluate technological procedures or systems prior to their introduction into production only on the basis of economic impact (added yield, improved product quality, and so on); we must also mandatorily consider how they influence the environment. We are facing an urgent need for intensifying surveillance over compliance with the laws on nature utilization, and mainly in the initial stages of violations of nature conservation (storage and use of fertilizers and pesticides, methods for protecting plants against erosion, and so on), rather than in the final stages, when it becomes much more difficult to avert the consequences.

The growing complexity of the ecological situation is also imposing a number of new problems upon the scientists. In order to solve them in the best way possible, the Republic Council for Coordination of Intersector Scientific-Technical Problems of the Moldavian SSR created the section "The Natural Resources of Moldavia and Their Use." It unites six major programs foreseeing development of a complex of scientific-technical

measures to improve the use of land and water resources, to seek, explore, and use minerals, to create low-waste and wasteless water-using production processes in industrial and agricultural production, and to develop the biological fundamentals of controlling, predicting, and conserving the animal and plant world. Twelve ministries and departments and more than 30 of the republic's scientific research institutes and institutions of higher education are participating in these programs.

One of the most important tasks is conservation and broader use of the plant and animal gene pool. Moldavia is an ancient seat of agriculture, where superior forms and varieties of agricultural crops (corn, beans, peavines, chickpeas, vegetables, fruits, grapes), distinguished by valuable characteristics such as resistance to drought and various diseases and pests, and high product quality, were created through folk breeding practices. But unfortunately many of these forms have already been lost to us. However, much also remains that we should preserve and multiply.

Also of important significance is frequent alternation of varieties and regionalization of a larger quantity of varieties and hybrids adapted to concrete ecological zones and not subject to injury by diseases and pests. World practice quite persuasively confirms the suitability of such an approach. When we create new pesticides and their mixtures, we must make sure that they are not only effective in controlling pathological manifestations in plants, but they are also less hazardous to the natural environment.

We must develop the scientific and practical foundations for programming the yields of agricultural crops on the basis of fuller use of the region's natural wealth (soil, light, the sun) and regulation of the basic factors of plant life (water and nutrient cycles). Experiments conducted in this direction are showing that this could raise the productivity of our fields by 1.5-2 times and significantly reduce the negative influences upon the environment. We must conduct broader research on the state of the environment and on the influence of its various pollutants upon the health of man and animals, and we must develop methods to remove gases from the air, and personal protective resources to be worn by workers at tobacco plantations and livestock complexes.

It would be very important in our republic to at least partially restore the natural background for reproduction of useful insectivorous birds, natural pollinators, game, and so on. This could be done by creating new landscapes and restoring old natural landscapes. It would be extremely useful in large orchards and vineyards. Transfer of the waters of the Danube to Moldavian territory, construction of the Danube-Nisporeny Canal in particular, will elicit an entire complex of new ecological problems outside our experience. I believe that the time has come to begin studying them seriously, and to forecast the consequences of such a transfer upon the surrounding natural environment.

We face a number of immediate problems in connection with the new program, recently adopted by the CPSU Central Committee and the USSR Council of Ministers, for accelerated development of orchard farming and significant enlargement of the production and procurement of fruits and berries in the Moldavian SSR. I am referring mainly to development of scientifically grounded recommendations for planting new industrially operated orchards, their irrigation, use of mineral fertilizers, toxic chemicals, and herbicides, land reclamation, and master plans for development and distribution of canning industry enterprises in the republic.

The principal task of the republic's scientists and producers is to develop the foundations for controlling ecosystems for the purposes of achieving sensible and harmonious development of every national economic sector. We must see that transformations being brought on by man through nature utilization would not elicit unforeseen unfavorable consequences in the environment and in the biosphere as a whole. To achieve this, such transformations must be preceded by serious, integrated study, by development of forecasts, and by investigation of not only the anticipated positive consequences but also the undesirable consequences, so that they could be eliminated from the given object or production process right during the course of planning.

The Communist Party and Soviet government display constant concern for improving the quality of the environment and making sensible use of natural resources. These problems were also reflected in decisions of the November (1979) Plenum of the CPSU Central Committee, documents of the Second Session of the USSR Supreme Soviet, in decrees of the 14th Plenum of the Central Committee of the Moldavian Communist Party, and in the proceedings of the 12th Session of the Moldavian SSR Supreme Soviet. These documents note that this is one of the greatest socioeconomic problems. The plan for economic and social development of the country and the republic in 1980 foresees an entire complex of measures in the nature conservation area. The country is allocating 1.9 billion rubles of state capital investments for these purposes, while our republic is allocating 36.4 million rubles. Significant assets are also being earmarked by the associations, enterprises, kolkhozes, and sovkhozes.

The task is to implement these plans faster and better, and to make sure that all party and economic organs, scientists and specialists, and all laborers of the cities and towns would participate actively in the movement to improve the quality of the environment.

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YAMALO-NENETSKIY OKRUG DEVELOPMENT PROBLEMS

Moscow SOVETSKAYA ROSSIYA in Russian 29 Jul 80 p 2

[Article by K. Mironov, First Secretary of the Yamalo-Nenetskiy Okrug Party Committee: "Bureaucratic Red Tape"]

[Text] This okrug, in which several European states would fit comfortably, is now famed not only for its harsh frosts and stinging blizzards, its reindeer herds and very valuable furs, but also for the new branches of industry being developed on an amazing scale alongside the age-old handicraft industries here.

This year alone, about 150 billion cubic meters of natural gas will be extracted from the underground storehouses here; that is on -third of what the country obtains from all other gas fields. The three million tons of petroleum which will be extracted from our deposits seems small relative to Tyumen', but extraction and deliveries will grow steadily. The current rates at which the tundra is being made habitable are unprecedentedly high. In just the concluding year of the five-year plan, we plan to do work worth more than a billion rubles at construction sites here.

It is for good reason that the main efforts of Tyumen' geologists are now focused on the district's prospecting mainlines. To this point, dozens-fold less of its mineral deposits have been surveyed than in the traditional petroleum and gas-extracting regions, but we have already discovered huge deposits of hydrocarbon raw material, as the ones in Urenga, Medvezh'ye, Yamburak, Komsomol'sk and a number of other places.

We greet with satisfaction the decision to intensify construction in Western Siberia, the decision that construction workers from Kazakhstan, the Ukraine, Lithuania, Latvia, Estonia, Moscow, Leningrad, and other republics, oblasts and cities will take an active part in transforming our area. The district's party organizations are already preparing to receive those sent from the fraternal republics and oblasts. Northerners have always been famed for their hospitality, and that good tradition will be followed in this case as well.

We are also gratified by the fact that the new organizations being created will assume sponsorship of the collectives of our oil and gas-field workers and will join in energetically in solving the problems of providing northerners with foodstuffs and improving their working and living conditions. Gas-field workers, for example, are actively developing subsidiary farming and are constantly concerned about expanding stockraising and hothouse shops; "Nydinskiy" sovkhoz is allocated the needed people and equipment for haying during the busiest period. Geologists have helped the Katruvozhskiy fishing sector become one of the best fishing subdivisions. Construction workers are quickly erecting housing for reindeer herdsmen on the district's northernmost sovkhoz, the "Yamal'skiy." As reinforcements arrive for the construction organizations, opportunities open up for broadening the scope of this sponsorship; our former small industry is being developed energetically, along with the new types of industry.

Reindeer breeding requires particular attention. Each year, Yamalites receive about 5,000 tons of reindeer meat. However, the reindeer meat's proportion of the food budget can and must be substantially increased, necessitating that a number of radical steps be taken. We should first of all concern ourselves with protecting pasture and increasing its productiveness. Unfortunately, more than two million hectares of tundra ground cover has been destroyed just in recent times due to a careless attitude towards fire and to the unjustifiably large number of routes laid out for various types of surface transport.

Party organs and the Soviets of People's Deputies have intensified work on educating people to be more conservation-oriented in recent years. Drivers and everyone else starting to work in the tundra now receives appropriate instruction before being sent to a project and equipment must be provided with spark suppressors (reindeer moss catches fire like powder, given the slightest carelessness) and with fire-fighting equipment. Administrative sanctions are levied against economic leaders who systematically violate environmental protection laws. But all these are protective, prophylactic measures, which are clearly inadequate. We are faced with the task of re-arming the branch completely. We know that reindeer breeders in certain regions of the country have successfully used so-called enclosed breeding, which makes the labor of the herdsmen and specialists easier, increases herd protection and productiveness. Expenditures are required for the enclosures, naturally, but experience shows that they are quickly recompensed, and it would be proper to make it the duty of the USSR Ministry of Gas Industry, Ministry of Petroleum Industry, Ministry of Construction for Petroleum and Gas Industry and Ministry of Power and Electrification, which lead the industrial utilization of the district, to plan these expenditures and anticipate construction of the needed facilities.

Experiments convince us that fattening reindeer during the harsh times of year yields outstanding results and that tundra reclamation is effective. One would think that the All-Union Agricultural Academy of Sciences imeni Lenin and the RSFSR Ministry of Agriculture would more persistently seek out and introduce into production improved methods of reindeer breeding and

land use, that they would solve more energetically problems associated with restoring the ground cover in spring and fall pastures and in places damaged by mechanized transport and otherwise.

But even if the tundra were fully protected and the botanical composition of its vegetation improved, reindeer breeders would still be our most important concern. The reindeer breeder's labor and everyday life remains practically as it was decades ago. We have in mind not only those who live in settlements, but also those who migrate with the herd throughout the year. The brigades are equipped with radio stations, pharmacies and foodstuffs, of course, and medical and cultural services have improved significantly, but quite a bit of work still needs to be done for the level of production organization and the social and cultural services for reindeer breeders to meet the demands of the times. We in the district have begun building intermediate centers where reindeer breeders will be able to rest, take a bath, watch a movie and stock up. But the rate of construction is not at all satisfactory. Here, too, we need more capital investment and, most of all, the more energetic assistance of the USSR Ministry of Gas Industry, Ministry of Geology and Ministry of Construction for Petroleum and Gas Industry in building such centers.

When people talk about the comprehensive development of the North, there seem to be no disagreements. But words are not always backed up by deeds. And even now, industrial enterprises begin building purification facilities only under pressure and most often only after production shops have reached full output. More than a third of the river boats have thus far not been equipped with devices for the collection of effluents (podshnevyye vody). Of course, the territory we have is considerable, and there are plenty of rivers and lakes, but there is a limit to which they can be polluted. And it must be remembered that nature is very easily injured in the north.

Road construction in the north can without exaggeration be called one of our main tasks. And in fact, about a million tons of freight now goes by rail to Labytnangi, where it is stored at the docks and then shipped by barge to Nadym in the brief polar navigation period (about two months). There, it is again put on shore and again loaded into rail cars and sent to Novyy Urengoy. And it even happens that freight is transferred from barge to barge on the Nadym. The multiple transfers not only damage a large amount of materials and products, but also make each kilogram of freight shipped as valuable as gold.

Of course, sparsely-populated areas are not provided with amenities and made comfortable places right away. But here is the paradox. Our district is becoming a larger supplier of energy with each passing year. At the same time, local enterprises are still being supplied with energy, and foremost electricity, through feeble networks built following a so-called start-up plan. They are very unreliable. It is not hard to imagine the possible consequences. The impression is given, however, that this does not upset the USSR Ministry of Gas Industry very much.

Several years ago, a plan for developing telephone networks in the district was proposed to the USSR Ministry of Communications. Its leaders concurred that this work was important. Nonetheless, as of now, not even the planning documentation for building the lines has been produced. As a result, even someone living in the district center must wait up to two weeks to talk with someone in any other city in the country. At the same time, there are reliable, efficient communications in a majority of the population centers in which gas-, petroleum- and construction-worker and geologist subunits are working. But those are departmental systems; they do not serve the population at large.

Such scattering of communications workers has already caused quite a bit of harm in the petroleum regions of Tyumen'. So that we will not subsequently have to count up losses and outlays at the morale level, the country's Ministry of Communications must conclude agreements with all the departments represented in the district and set up this important branch at the state level.

In conclusion, I should like to touch on two more factors facilitating securing people at northern construction projects, not just for brief periods, but for many years. And here is why that is important. So long as a new settler doesn't love the north and doesn't understand nature, unique and original, one cannot demand an attitude of conservation towards it. And it takes some experience to develop a love of nature. I am confident that in the near future, both those who have worked here for a long time and those who have never been here before will be traveling in the district on tourist authorizations. In order to preserve nature in its pristine state, we need to create several parks. There has long been talk of this, but action, which depends on the decisions of the RSFSR Ministry of Agriculture, is not moving forward as much as one would like.

Moreover, we must make life in the north more diversified and more beautiful through our own efforts. I have in mind the construction of hothouses and greenhouses, raising forests in the tundra, and landscaping settlements. All this must be anticipated in the plans and estimates for those who will be working here.

The district party organization is directing all its organizational and political work towards a worthy greeting to the 26th CPSU Congress. We hope that the central departments will be of maximum assistance in solving important economic and social problems which will determine the future development of our northern outpost.

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DETERMINING EFFECTIVENESS OF ENVIRONMENTAL PROTECTION EXPENDITURES

Moscow EKONOMICHESKAYA GAZETA in Russian No 33, Aug 80 pp 13-14

[Text] The USSR Academy of Sciences' Scientific Council for the Economic Effectiveness of Fixed Assets, Capital Investments and New Equipment and the USSR Academy of Sciences' Institute of Economics have worked out temporary methods of determining the economic effectiveness of expenditures on measures to protect the environment. They are recommended by the USSR Gosplan's State Experts Commission for calculating the effectiveness of expenditures on environmental protection measures until methods are approved for determining the economic effectiveness of carrying out environmental protection measures and methods of evaluating the economic loss caused the national economy by environmental pollution are developed, as is anticipated by point 23 of the CPSU Central Committee and USSR Council of Ministers Decree No 984 of 1 December 1978 "On Additional Measures to Strengthen Environmental Protection and Improve the Use of Natural Resources."

1. General Provisions

1.1 The Methods stem from the basic provisions of the "Standard Methods of Determining the Economic Effectiveness of Capital Investments" (1969). These provisions are developed as applicable to environmental protection measures for the purpose of determining the economic effectiveness of capital investments and operating expenses necessary to carry them out.[1]

The Methods are intended for use in analyzing the economic effectiveness of environmental protection expenditures on:

-- planning and choosing variants for building facilities, installations and devices to protect the environment;

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1. Hereafter, such capital investments and operating expenses are referred to as "environmental protection expenditures." The effectiveness of expenditures on measures to use natural resources intelligently is not examined in these Methods.

-- determining the sequence in which these facilities, installations and devices are to be built;

-- substantiate economically the main stages in achieving normative environmental quality;

-- evaluate actual results of measures being carried out;

-- evaluate the environmental protection results of activity by enterprises, associations, ministries and departments, city and village Soviets of People's Deputies;

-- economic incentives to improve the effectiveness of the measures being carried out.

1.2 The impact of environmental protection expenditures is manifested at different levels:

a) the initial impact is to reduce the negative influence on the environment and to improve its condition and is manifested in a reduction in the amount of pollutants and the concentration of harmful substances in the atmosphere, water and soil, in an increase in the amount of land suitable for use, and in a reduction in noise and vibration levels and other effects.[1]

b) the final (comprehensive socioeconomic) impact is to raise the standard of living of the population, improve the effectiveness of social production and increase the national wealth. This effect is manifested in the social and economic results enumerated below.

Social results are expressed in improvement in the physical development of the population and in a reduction in morbidity, an increase in the lifespan and in the period of active activity, in improvement in working and recreation conditions (including protecting the gene pool), in preserving the aesthetic value of the natural landscape, natural monuments, reserves and other protected areas, in creating conditions favorable to growth in the creative potential of the individual and to developing culture, and in perfecting the moral consciousness of people.

The social results, if represented in monetary form, are partly reflected in the overall economic impact of environmental protection measures.

Economic impacts consist in saving or preventing losses of live and embodied labor and are expressed in the sphere of material production in an increment in the amount of net output or profit (in a reduction in net cost in individual branches and enterprises), in the nonproductive sphere in a saving of production and services expenditures, and in the personal consumption sphere in a reduction in personal expenses resulting from environmental pollution.

1.3 The ecological effectiveness of environmental protection expenditures is determined by relating initial impact to resulting expenditures.

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1. The Methods analyze measures aimed at preventing, reducing or eliminating established processes leading to negative consequences of change in the environment. But measures caused by accidental worsening of the state of the environment are not examined in the Methods.

Initial effects are calculated in terms of the difference in indicators of negative effect on the environment and difference in indicators of the state of the environment prior to and after the steps are taken.

The social effectiveness of environmental protection expenditures is measured as the ratio of physical indicators expressing the social result to expenditures required to achieve it. The social impact is defined by the difference in indicators describing change in the social sphere as a result of environmental protection measures.

The economic effectiveness of environmental protection expenditures is established by measuring economic results against the expenditures resulting in them. The economic impact is calculated as the difference in economic results of material production, expenditures in the nonproductive sphere, expenditures from the state budget and personal expenditures given the current and projected state of the environment or the state which could occur were environmental protection measures not to be implemented.

In working out measures to prevent the negative consequences of disrupting the environment and on improving its condition, we need to anticipate achieving environment characteristics within the limits set by existing medical-sanitation and ecological norms, and when making long-range forecast calculations, with consideration of projected change in these norms.

The content and sources of the initial data for determining expenditures on and the economic impact of carrying out environmental protection measures are given in appendices 1 and 2 (not published here).

1.4 The initial and social impact and corresponding effectiveness indicators are used to supplement the economic impact and effectiveness indicators and serve to:

-- determine the actual level and normatives of consolidated indicators of expenditures needed to achieve the established amount of reduction in harmful discharges and to support a prescribed environmental condition;

-- calculate the results of the expenditures whose impact is not expressed directly in monetary terms (preventing a reduction in the gene pool of animals and plants not raised, preserving the aesthetic value of natural landscapes, natural monuments, and so on).

Establishment of the fact that the economic and supplemental indicators describing the results of environmental protection measures are in different directions serves as the basis for monitoring the appropriateness of deciding to implement a measure.

1.5 Calculations of the overall and comparative economic effectiveness of environmental protection expenditures in accordance with these Methods are done when working out forecasts and plans for the economic and social development of the USSR and union republic national economies, environmental protection work plans, comprehensive territorial environmental protection plans and plans for using natural resources intelligently, general plans for

developing cities, drafting and substantiating plans for large enterprises and installations. These calculations also are used to evaluate and encourage the results of the environmental protection activity of enterprises, associations, ministries and departments, city and village Soviets of People's Deputies.

1.6 These Methods are used to refine existing and develop new branch instructions on determining the economic effectiveness of environmental protection expenditures and normatives reflecting the impact (loss-prevention) achieved as a result of ensuring the required environmental quality.

1.7 When individual types of economic effects of improving or preventing reduction in the productiveness of natural resources are calculated, we use approved economic appraisals of land, water, timber and mineral raw material resources. For those types of resources for which such economic appraisals have not yet been developed, the economic impact is determined as applicable to a corresponding calculation level (see point 2.3) using the indicators of net output, profit and reduction in net cost.

1.8 Regardless of sources of financing, environmental protection capital investments include one-time expenditures on:

-- creating new and renovating existing fixed assets which reduce (prevent) negative economic activity influence on the environment;[1]

-- measures which directly influence elements of the environment for the purpose of improving their condition and not generating fixed assets;

-- production technology modifications done exclusively for the purpose of reducing negative influences on the environment;

-- production technology modifications ensuring that environmental protection goals will be reached.

1.9 Environmental protection operating expenses include:

-- current expenditures on maintaining and servicing environmental protection fixed assets as enumerated in appendix 3;[2]

-- current expenditures associated with measures directly influencing environmental elements in order to improve their condition, both relative to basic activity and implemented using annual allocations from the budget and other sources;

-- additional expenditures on operating fixed production assets which result from improvement in production technology for the purpose of reducing the unfavorable influence of economic activity on the environment;

-- expenditures on services associated with protecting the environment.

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1. A detailed list of environmental protection capital investments is given in appendix 3.

2. Current expenditures to maintain and service fixed assets include annual expenditures on basic and supplemental wages to servicing personnel, planned-preventive, routine and major repairs, depreciation deductions for full restoration, energy expenses, expenditures for reagents, and other types of current expenditures both part of output net cost and financed through the budget and other sources.

1.10 Given comprehensive capital investment and operating expenditures on environmental protection facilities and production facilities in which it is difficult to delineate that portion going to protect the environment, that portion is determined by calculating in accordance with the amount of work done or the impact achieved in each of these areas, as well as on the basis of analogs, in terms of economic indicators of plans of the same nature being implemented or in terms of consolidated norms and cost sheets.

1.11 When determining the full economic impact of environmental protection measures, consideration must be given to preventing (reducing) losses throughout the territory in which the negative consequences of disturbing the environment have been manifested -- city, urban center, industrial center, urban or rural rayon. This determines the necessity of a summary recording of economic effects at enterprises and in branches carrying out environmental protection measures, at enterprises and in branches using the improved natural resource, as well as the savings from reducing additional expenditures from the state budget and increasing the real incomes of the population working or living on that territory with the improved environment.

1.12 When calculating expenditures and impact for environmental protection measures being planned for a long period, consideration must be given to factors which might influence change in them.

Such factors include the following:

-- changes in the condition of the environment caused by production growth, by carrying out (or not carrying out) the complex of environmental protection measures in the time periods planned, as well as by change in the population living under the conditions of the planned state of the environment;

-- higher demands as to environmental quality;

-- continued growth in large cities and urban centers, increase in their numbers and in the number of people living in them;

-- changes in the cost of construction-installation work and equipment;

-- the development of science and engineering towards creating new technical means and technologies which reduce the negative influence of production activity on the environment;

-- growth in net output volume of another indicator of output volume used to calculate labor productivity;

-- an increase in the relative amounts of funds being allocated for public health, social insurance and social security;

-- a rise in the productiveness of agricultural and forest land, change in fish resources;

-- a rise in the value of mineral raw material resources in connection with the necessity of drawing less-effective deposits into operation.

Calculations of the comparative economic effectiveness of environmental protection measures with consideration of the time factor are done in accordance with point 3.1.

1.13 Data on change in factors influencing the size of environmental protection expenditures and the impact are accepted based on a comprehensive

program of scientific and technical progress, economic and social development plans for the USSR and the union republics, programs to solve the most important scientific and technical problems and problems of using natural resources comprehensively, general plans for developing individual branches and economic regions, comprehensive territorial environmental protection plans, and also plans for using by-products and side products, recycled materials and other resources.

2. Determining the Overall Economic Effectiveness of Expenditures on Measures to Protect the Environment

2.1 The indicator of overall (absolute) economic effectiveness of the /entire amount/ of environmental protection expenditures is the ratio of the annual amount of full economic impact to the sum of the operating expenses and capital investments causing this impact, as given in identical dimensionality in accordance with the effectiveness normative:

$$E_{ij} = \frac{\sum_{i=1}^{n} \sum_{j=1}^{m} E_{ij}}{(S_i + E_n) \times C_i} \qquad (1)$$

E_{ij} is the economic impact of the i-th type (i = 1, 2, 3...n) of preventing (reducing) losses at the j-th facility (j = 1, 2, 3...m) located in a zone of improved environmental condition and calculated in accordance with points 2.4 and 2.13 of these Methods.

S_i is annual operating expenses to service and maintain fixed assets causing the full economic impact.

C_i is capital investments on constructing an environmental protection facility (or group of facilities).

E_n is the normative environmental protection capital investment effectiveness factor. Temporarily, until the USSR Gosplan approves normatives for the effectiveness of capital investments in environmental protection measures, this value is accepted as being 0.12 for the national economy as a whole.

When necessary, the overall (absolute) economic effectiveness of /capital investments/ in environmental protection measures is determined by relating the annual amount of the full economic impact minus operating expenses on maintaining and servicing environmental protection facilities to the capital investments ensuring that result:

$$E_n = \frac{\sum_{i=1}^{n} \sum_{j=1}^{m} E_{ij} - S_i}{C_i} \qquad (2)$$

When developing environmental protection measures and plans for calculating the overall effectiveness of expenditures on these measures, the economic effectiveness indicators are compared with the normatives already developed[1] and also with indicators of expenditures on similar measures at the leading enterprises of corresponding branches which have ensured achieving the planned final environmental protection results.

2.2 The following serve as additional indicators of the effectiveness of environmental protection measures:

a) the ratio of the reduction in the value of the indicator describing the negative influence of economic and other activity on the environment to the expenditures causing it:

$$E_{av} = \frac{\Delta B}{(S_i + E_n) \times C_i}, \qquad (3)$$

where ΔB is the reduction in the value of the negative influence on the environment (see point 1.2, a);

b) the ratio of the indicator describing improvement in the condition of the environment of a region to the expenditures causing it:

$$E_{ac} = \frac{\Delta R}{(S_i + E_n) \times C_i}, \qquad (4)$$

where ΔR is the indicator describing improvement in the condition of the environment in the region (see point 1.2, a).

2.3 The economic impact of making environmental protection expenditures is determined in general and in cost-accounting terms:

a) as an overall impact calculated for the national economy as a whole, the economies of the union republics, branches of the national economy, branches and subbranches of industry, agriculture, transport and construction, as well as in branches of the nonproduction sphere operated on a cost-accounting basis -- in terms of increment in economic appraisal of natural resources or in terms of increment in net output;

b) as a cost-accounting impact calculated for individual enterprises and associations, administrative rayons, territorial-production complexes and industrial centers -- in terms of increment in profit or reduction in net cost, and as we change over to calculating net output (normative) -- in terms of increment in the size of the latter. In branches, organizations and institutions of the nonproductive sphere financed in full or in part from the budget, the methods of calculating overall and cost-accounting

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1. Normatives of the economic effectiveness of expenditures on environmental protection measures as applicable to each type of natural resource are given in the branch instructions for determining the economic effectiveness of expenditures on environmental protection measures and are approved by the USSR Gosplan.

impacts are identical and the impact is determined in terms of amount of savings of average annual expenditures.

2.4 The overall economic impact of reducing morbidity (partial or full loss of the ability to work) as a consequence of preventing or reducing environmental pollution and of other environmental protection measures is determined as the sum of the following impacts:

a) the impact of preventing losses of net output due to worker illness, in the material production sphere:

$$E_{no} = O_n \cdot I \cdot (W_2 - W_1), \tag{5}$$

where O_n is the average amount of net output accounted for by one man-day worked, I is the number of workers taken ill or diverted from production to care for family members ill for reasons caused by environmental pollution during the course of the year, and W_1 and W_2 are the average annual number of man-days of work per worker prior to and after environmental protection measures are carried out;

b) the impact of reducing total payments to the population from the social insurance fund while temporarily or permanently disabled by illness caused by environmental pollution:

$$E_{rt} = B_p \cdot T_g \cdot (W_2 - W_1), \tag{6}$$

where B_p is the number of people receiving grants as a result of illness resulting in temporary or permanent disability caused by deterioration of the environment during the course of the year, and T_g is the average amount of the temporary disability grant accounted for per day of illness;

c) the impact of reducing expenditures in the public-health branch to treat workers for illnesses caused by environmental pollution:

$$E_p = (E_o \cdot P_o \cdot D_o) + (E_i \cdot P_i \cdot D_i), \tag{7}$$

where E_o, E_i are average expenditures in the public-health sphere accounted for by one day of illness under out-patient and in-patient conditions, respectively, P_o, P_i are the number of patients being treated for illnesses caused by environmental pollution, given the same conditions, and D_o, D_i are the average number of days of illness per patient, same conditions.

2.5 The economic impact of increasing worker labor productivity given improvement in the condition of the air is determined as follows:

-- the overall impact in material production -- in terms of annual increment in net output, and in branches of the nonproductive sphere -- in terms of reduced expenditures on work and services;

-- the cost-accounting impact at enterprises and associations of material production -- in terms of annual profit increment, in organizations and institutions of the nonproductive branches -- in terms of amount of expenditures saved in performing work and rendering services.

2.6 The economic impact of preventing (reducing) losses of raw material, fuel, basic and auxiliary materials as solid waste, untreated waste water,

discharged gases and dust, is calculated as follows:

-- when determining overall impact -- in terms of annual increment in net output;

-- when determining cost-accounting impact -- in terms of annual increment in profit or as the product of usable raw material, fuel and finished products times the wholesale cost of producing them from wastes, minus current expenditures.

2.7 a) The overall impact from the more productive use of basic production equipment, given improvement in the environment, is evaluated in terms of annual increment in net output in connection with the reduction in equipment down time for maintenance, with the increase in the machinery time available, with the reduction in expenditures on all types of repairs and services, and with labor productivity growth for workers employed in servicing equipment which is more reliable and maintainable;

b) The cost-accounting impact from preventing premature wear on fixed assets when using a natural resource of poorer quality or operating equipment in a polluted environment is calculated as:

-- the savings in expenditures on current and major repairs in connection with implementing environmental protection measures. The amount of savings is determined as the product of the reduced number of repairs resulting from the lower level of environmental pollution times the cost of one repair;

-- the increment in profit from increasing equipment service life;

$$E_o = \Phi \cdot F_p \cdot (T_2 - T_1) \qquad (8)$$

where Φ is the average annual cost of the equipment, F_p is the fixed assets profitability factor, T_1, T_2 are equipment productivity prior to and after the measures are carried out, respectively.

2.8 a) The overall impact from increasing the productiveness of agricultural land (or preventing a reduction in it) is determined based on the difference in the economic appraisal of the land prior to and after the environmental protection measure is carried out;

$$E_a = (A_2 - A_1) \cdot M, \qquad (9)$$

where A_1, A_2 are annual economic appraisals of agricultural land prior to and after the measures are carried out, in rubles per hectare, and M is the area covered by the environmental protection measure, in hectares.

In the absence of developed and approved economic appraisals of land resources, the overall impact from increasing or preventing a decrease in land productiveness is determined in terms of average annual increment in net output:

$$E_{a1} = (O_2 - O_1) \cdot M, \qquad (10)$$

where O_1, O_2 are average annual amounts of net output obtained per unit of arable land prior to and after the measures are carried out, in rubles/ha;

b) The cost-accounting impact from increasing the productiveness of agricultural land is determined in terms of average annual profit increment (given change in output net cost to the land user after environmental protection measures are carried out):

$$E_{ag} = Y_2 \cdot (P-N_2) - Y_1 \cdot (P-N_1), \qquad (11)$$

where Y_1, Y_2 are average annual output over many years from the area covered by the environmental protection measure prior to and after it is carried out, respectively, in units of output, P is the wholesale (purchase) price of a unit of a given type of output, N_1, N_2 are the net cost of a unit of output prior to and after the environmental protection measure is carried out, respectively.

2.9 a) The overall impact of improving (or preventing a decrease in) the quality of industrial output, fishing and agricultural output, is evaluated in terms of annual increment in net output after an environmental protection measure has been carried out;

b) The cost-accounting impact of improving (or preventing a decrease in) the quality of industrial output, fishing and agricultural output, given improvement in product quality and changing prices and net cost, is calculated using the formula:

$$E_{qo} = A_1 \cdot [(P_1-N_1) - (P_2-N_2)], \qquad (12)$$

where A_1 is the average annual amount of improved output, in units of measure, P_1, P_2 are the prices of a unit of output of improved or unchanged quality, respectively, in enterprise wholesale prices (excluding turnover tax), and N_1, N_2 are the net cost of a unit of improved or unchanged output, respectively.

2.10 a) The overall impact of reducing (or preventing an increase in) expenditures on additional treatment of polluted water and air, reducing noise or vibration levels, wave or radiation effects, to normative indicators adopted in technological processes or when resources are used nonproductively is determined in terms of annual increment in net output in the sphere of material production or in terms of reducing current expenditures in the nonproductive sphere;

b) The cost-accounting impact of reducing or preventing an increase in average annual expenditures on additional treatment of polluted natural resources is determined using the formula:

$$E_a = (N_1-N_2) \cdot A, \qquad (13)$$

where N_1, N_2 are treatment net cost calculated per unit of resources prior to and after environmental protection measures have been carried out, respectively, and are given in yearly terms, and A is the amount of the resource being used.

When preventing the pollution of water and air being consumed to meet production needs and for farming or drinking or housing and municipal services purposes is accompanied by the liquidation of fixed assets, calculations of the economic effectiveness of environmental protection measures take into account the residual value, which is calculated to be the difference between the replacement cost and the amount of depreciation deducted, minus the sale price.

2.11 The overall impact of reducing expenditures by municipal and personal services and other branches of the nonproductive sphere on waste treatment and the clean-up of polluted territory, repairing housing and public buildings, replacing shriveled up plants, and so forth, is determined as the total expenditures saved (to meet nonproduction needs) and the increment in net output for branches and enterprises operating on a cost-accounting basis.

The cost-accounting impact is calculated in this instance in terms of reduction in average annual actual expenditures in the corresponding branches and enterprises, in terms of lower net cost and lower maintenance expenditures, and so on.

2.12 The overall impact of environmental protection measures aimed at preventing the death, increasing the productiveness and replacing forest plants which have been negatively influenced by economic activity is determined in terms of increment in the annual economic appraisal of forest resources.

The cost-accounting impact of carrying out the indicated measures can be calculated in terms of reduced average annual operational expenditures from the budget and other types of expenditures or in terms of lower net cost of work to restore stands of timber.

2.13 The economic impact of reducing expenditures by the population resulting from environmental pollution is evaluated in terms of price lists and rates for doing corresponding types of work and services as set for enterprises and organizations of the nonproductive sphere.

3. Determining the Comparative Economic Effectiveness of Environmental Protection Measures

3.1 When developing long-range forecasts and programs for environmental protection in a region and planning environmental protection facilities and complexes, the necessity arises of choosing the most effective variants of technical resolutions to deal exclusively with environmental protection tasks and variants of multipurpose measures in which other production tasks are also resolved along with environmental protection tasks.

The indicator of the economic effectiveness of the variants being compared is the minimum aggregate operating expenses and capital investments, given in yearly terms and with consideration of a time factor.

a) When carrying out short-term measures (just as with long-term measures with approximately equal amounts of annual operating expenses and capital investments in each year of the period of implementation), a variant is chosen which describes a minimum amount of expenditures, given in yearly terms, as determined using the formula:

$$S_i + E_n \cdot C_i \rightarrow \text{minimum}. \qquad (14)$$

Value E_n for capital investments in new equipment is taken to be 0.15, until the "Branch Instructions" are approved.

The calculated expenditures can also be computed using the formula:

$$C_i + T_n \cdot S_i \rightarrow \text{minimum}, \qquad (15)$$

where T_n is the normative capital investment reimbursement period (the reciprocal of E_n);

b) When carrying out measures whose actualization or the achievement of whose effects (restoring timber stands, recultivating mined-out areas, restoring fish populations and others) requires long periods and in which operating expenses and capital investments change over time, the full expenditures calculated by the start of the calculation period are determined using the formula:

$$\sum_{t=1}^{T} \frac{C_i + C_a + M_{it}}{(1 + E_{nc})^t} \rightarrow \text{minimum}, \qquad (16)$$

where C_i is initial capital investments in environmental protection measures, C_a is additional capital investments needed to ensure normal operation of environmental protection facilities in the t-th year of operation (t=1, 2, 3 ...T), M_{it} are operating expenses in the t-th year to service and maintain fixed assets, and E_{nc} is the normative calculation factor for expenses at various times, which factor is adopted in accordance with the branch instructions on determining the economic effectiveness of expenditures on environmental protection measures. Temporarily, until the USSR Gosplan approves branch instructions, the calculation normative is set at 0.08 for ordinary expenditures and 0.1 for expenditures on new equipment and 0.03 for expenditures to restore stands of timber.

3.2 Achieving identical environmental quality, with consideration of local conditions, is a condition of calculations of the comparative economic effectiveness of environmental protection measures and variants of multipurpose planning and economic resolutions.

Moreover, the variants should be comparable in terms of:

-- population covered by the effect of the environmental protection measure;

-- territory (zone of dissemination of results of implementing an environmental protection measure), amount and composition of fixed assets subject to its impact;

-- time for which environmental protection facilities and complexes will be in operation from the moment the first line of construction is put into operation until the end of the calculation period (forecast horizon).

3.3 The environmental measure variants and multipurpose planning and economic resolutions being compared must meet the demands anticipated by the state standards system in terms of working conditions, technical and ergonomic indicators, use of recycled resources and wastes, and other normative regulations.

When comparing variants which differ in duration of facility and complex construction, we should also take into account the actual impact created during the long period over which they are put into operation.

3.4 When two or several construction variants are compared (portions of which do not meet the demands set by environmental quality standards), the latter should also contain technical resolutions which eliminate these differences and which correspondingly increase expenditures on the adjusted variants by the amount needed to meet normative requirements.

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BALTIC SEA POLLUTION ABATEMENT EFFORTS

Tallin SOVETSKAYA ESTONIYA in Russian 2 Aug 80 p 2

[Article by A. Pyldroo, Chairman of the Estonian SSR State Committee for Land Reclamation and Water Management: "A Cleaner Baltic Sea"]

[Text] Our republic is small, only about 45,000 km^2. However, the seacoast is quite long, 1,240 km on the mainland and 2,540 km on the islands.

Naturally, given this geographic position, the cleanness of the Baltic Sea and especially of the coastal waters is of exceptionally important significance to our republic. Our largest cities and settlements and a majority of our recreational and sports complexes and Pioneer camps are located on the seacoast.

The other Baltic republics and many foreign countries are also extremely interested in the cleanness of the Baltic Sea. That is why a "Convention on Protecting the Maritime Environment in the Baltic Sea Region" was adopted in 1974 and has been ratified this year by all the Baltic countries, including the Soviet Union.

Scientific research has established that, inasmuch as the Baltic Sea is intracontinental, young and comparatively shallow, it is especially sensitive to various kinds of pollution.

Its water area is only 385,000 km^2, that is, 940 times less than that of the Pacific Ocean, but the volume of water in the Baltic Sea is 61,450 times less than that of the Pacific Ocean. The catchement area of the Baltic Sea is approximately four times greater than its surface area.

About three percent of the population of the globe lives in the catchement area of the Baltic Sea, but the volume of industrial production here is upwards of 1/15th the world total, not to mention the numerous ships in the fleets of all the Baltic countries.

More than 250 rivers, with an annual average flow of 558 km^3, flow into the Baltic Sea. Theoretically, such an inflow of river water into the Baltic Sea should replace its entire volume in 40 years. But inasmuch as the sea

is intracontinental and the depths are shallow in the Danish bays, the deep water in it stands still and accumulates pollutants, especially petroleum products.

The exchange of water between the Baltic Sea and the ocean occurs almost exclusively through the North Sea, which is no less polluted than the Baltic Sea, so the self-cleaning effect of our sea is very doubtful; this is also testified to by the increasing concentration of pollutants.

The Convention on Protecting the Maritime Environment of the Baltic Sea Region anticipates stopping all discharges of pollutants from seagoing and other vessels, including ballast and bilgeway (petroleum-bearing) water, various petroleum precipitates and residues, garbage and operating wastes.

The convention also anticipates that the discharge of pollutants into the sea from coastal enterprises and cities will be stopped.

In view of the demands of this document, the Soviet government has adopted a number of decrees and the USSR Supreme Soviet Presidium has made changes in and additions to existing legislation on responsibility for polluting the sea with substances harmful to the health of people or the living resources of the sea.

What are these changes?

According to the additions, those to blame for polluting the sea so as to have the effect of damaging the maritime environment, harming the health of people or the living resources of the sea, harming recreation zones or other legitimate types of use of the sea, are deprived of freedom for a period of up to one year, sentenced to corrective labor for up to one year, or fined up to 10,000 rubles, depending on the circumstances.

Those to blame for polluting internal seas and territorial waters of the USSR as a consequence of unlawfully discharging substances harmful to the health of people or the living resources of the sea and damaging recreation zones from ships or of failing to take steps to prevent such damage are deprived of freedom for up to two years or are sentenced to corrective labor for up to one year or are fined up to 15,000 rubles; this applies equally to pollution of open seas in violation of USSR international agreements.

Even harsher punishment awaits those who cause substantial damage to the health of people or living resources of the sea, recreation zones or other legitimate types of use of the sea. They are deprived of freedom for up to five years or fined up to 25,000 rubles.

It also is anticipated that failure to report to responsible officials persons discovered polluting the sea, and in particular seagoing and other ship captains and aircraft commanders, with the effect of damaging the maritime environment or recreation zones in punishable by corrective labor for up to one year or a fine of up to 500 rubles.

Administrative charges may be brought and fines of up to 100 rubles levied for comparatively minor violations of the rules for protecting the sea from pollution.

Inasmuch as the importance of promptly implementing measures to protect the maritime environment within the coastal and internal sea waters of the republic and of monitoring the observance of requirements stemming from the Convention on Protecting the Maritime Environment of the Baltic Sea Region and corresponding government decrees is obvious, a Maritime Water Protection Inspectorate was created in April of this year under the Estonian SSR State Committee for Reclamation and Water Management and was given broad rights and powers. What are they?

Officials of the Maritime Water Protection Inspectorate have the right to visit and inspect seagoing and other ships and, when necessary, to stop them or keep them in port, regardless of the departmental affiliation of the ships, including foreign ones, to disclose the reasons for and circumstances under which the sea is being polluted in accord with existing statutes and the Water Legislation of the USSR and Estonian SSR.

Inspectorate officials can, upon submission of official identification, go on board ships and other vessels in ports and harbors and at all republic organizations, enterprises and facilities within their jurisdiction to monitor observance of the USSR and Estonian SSR Water Legislation and existing water resources use and water pollution regulations and rules for meeting and carrying out the requirements of international maritime environment protection agreements to which the Soviet Union is a party and, when necessary, draw up appropriate documents.

The Maritime Water Protection Inspectorate is given the right to issue injunctions regarding water use and protection and to set time limits on eliminating shortcomings revealed; when necessary, it can bring administrative charges against those responsible or send materials to the procurator's office for bringing criminal charges.

The inspectorate is also given the right to bring suit against organizations, enterprises and facilities monitored by it, as well as against officials and citizens and against the captains of foreign ships to levy for the state fines to recompense damage cause by pollution of the internal seas and territorial waters of the USSR within the Estonian SSR.

The Maritime Water Protection Inspectorate is a young organization, just beginning its activity, but it already monitors the provision of seagoing ships and other vessels with the necessary water-protection equipment by republic ship-building organizations, as well as the implementation of plans for building and renovating water-management and water-protection facilities at sites monitored by it and of measures to use water resources intelligently and protect the sea from pollution.

When necessary, the Maritime Water Protection Inspectorate can demand that officials submit planning documentation and other documents supporting the right of a facility being monitored to use water and discharge waste water and, with the concurrence of the Estonian SSR State Committee for Reclamation and Water Management, can abrogate that right to use water and shut down enterprises, shops and other production facilities being monitored which systematically pollute water with waste discharges and which do not take the necessary water-protection steps within the time limits set.

With a view towards meeting republic interests in protecting coastal and internal sea water from pollution, the inspectorate offers its opinions on plans for scientific research to be done by republic scientific organizations in the Baltic Sea basin. It also must direct republic departments, organizations, enterprises and farms to put in suitable sanitary condition the seacoast, beaches and other recreation areas and to restore coast-protecting structures damaged by the elements; when necessary, river mouths must be deepened where they flow into the Baltic Sea basin if they are of important national economic significance.

The inspectorate has the right to give its opinion, which is binding, as to full or partial deprivation of bonuses to supervisory personnel of republic enterprises, organizations and facilities being monitored which have not carried out water-protection plans and corresponding monitoring agency directives within the time limits set.

It would seem that the recently created Maritime Water Protection Inspectorate under the Estonian SSR State Committee for Reclamation and Water Management will definitely contribute to protecting the coastal sea water of our republic from harmful contamination.

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ELECTROFLOTATION PROMISING FOR SMALL ENTERPRISES IN BASHKIRIA

Moscow TRUD in Russian 19 Aug 80 p 3

[Article by A. Laletin: "Clean Rivers"]

[Text] "The river begins with a sky-blue stream" -- everyone knows these words from a popular song. Just as they know that many of these streams, alas, are by no means sky-blue, so polluted are they by various discharges. In Bashkiria, for example, pollution-free sources were to be found only in certain mountain-forest regions by the mid-1970's.

Recently, much has been and is being done to protect our waters. The large enterprises have large purification facilities. More and more waste-free technology and water-circulation systems are being introduced into production. And the first results are already visible: the republic's primary water artery, Belaya River, has become noticeably cleaner, as the ichthyofauna has been restored to it.

However, as a whole, the situation concerning waste water purification cannot be considered satisfactory.

Even large, technically advanced installations do not always succeed in keeping water quality within the sanitation norms. And what about the numerous small and medium-sized enterprises, agricultural, personal-services and other facilities which either have no such installations or have to be content with primitive means of "conventional purification"?

It is just such facilities which produce the greatest waste of the kind which does not lend itself to purification by ordinary methods. This waste water contains various fats, petroleum, petroleum processing by-products, and insoluble organic substances. Every year, more and more detergents and other products which do not decompose biologically reach the water supply. In order to reduce such discharges [illegible] entrations permitted by the sanitation norms, enterprises usually dil[illegible] with fresh water, increasing fresh water expenditures dozens-fold. In[illegible] much as water is free here, using this precious gift of nature wastefully is not reflected seriously in the economy.

It is understandably inexpedient to build expensive, complex biological purification facilities at every small facility, but neither can we reconcile ourselves to this state of affairs. What is to be done? Are there no effective, relatively simple, economical waste water purification methods accessible to small enterprises?

There are. One, and I suppose the most successful one, was developed by specialists of the Physics Department at Ufa Petroleum Institute under the leadership of Doctor of Technical Sciences and Professor I. L. Markhasin.

A turbid liquid tinged with brown, called "hypothetically clean" waste water from the Ufa Motor Vehicle Center of the VAZ [Volga Motor Vehicle Plant], is poured into a glass compartment shaped like a flattened aquarium. Countless suspended particles not yielding to ordinary precipitation are suspended in the liquid.

A laboratory assistant throws a knife switch and sparks begin to dance inside the vessel. Myriad miniature bubbles rush upwards from the electrodes, carrying the impurities up with them. The water begins to clear from below, and a layer of dirty scum accumulates on the surface and is gradually removed through drain openings. After half an hour, the liquid is completely transparent, and you could only find the infrequent particles of the impurities in it using a powerful microscope.

Another vessel is filled with a similar turbid, whitish water from a dairy combine's discharge. The same process is repeated, the hard-working bubbles assemble diligently, and carry off to the surface particles of albumin, fat and other admixtures.

"This phenomenon is called electroflotation," explains the professor. "In general, we have long known about mechanical flotation and use it extensively in enriching mineral ores and to extract individual components from liquids. The method is based on the ability of air bubbles passing through a liquid containing particular components to adhere to particles of those components and carry them off to the surface, forming a scum there. The needed substances are extracted from it. Extraction selectivity is achieved by adding various reagents to the liquid.

However, in mechanical flotation, small particles of hydrocarbons and other impurities in suspension are not extracted from the liquid. Mechanical flotation requires bulky equipment and the use of expensive and not always harmless reagents.

In electroflotation, a direct current of electricity is passed through the liquid. The water is electolyzed and gas bubbles are generated. They capture the microparticles and carry them to the surface, forming a layer of foam. Effective, inexpensive electroflotation methods have now been developed and the apparatus for using them is available, as are the first practical results.

For example, an electroflotation device mounted on the Krym steamship processes water after the ship's engines. It is highly contaminated with oils and petroleum products (up to four grams per liter). An installation the size of an ordinary desk processes about 800 liters of liquid per hour and discharges into the sea water with 0.003 gram of residual substances per liter, three-fold less than is permitted by the sanitation norms.

The wattage of this installation equals that of an ordinary electric iron. It takes 0.4 kW-hr to clean a cubic meter of water; it costs 6-12 kopecks to process a cubic meter of waste water, depending on the degree of contamination. Incidentally, the steamship obtains some additional benefit from selling the wastes recovered as fuel.

Waste water is processed in a comprehensive manner, using a number of physical and chemical processes which include, in addition to electroflotation, electrophoresis, electrocoagulation, photoinitiation, absorbtion, filtration and microarc discharges. These processes are combined and varied as a function of the type of waste water, the composition and amount of the contaminants, the depth of purification and degree of neutralization required.

A "gamut" of installations able to handle from 10 to 250 cubic meters of liquid per 24-hour period has been developed. It has become possible to provide very different water sources, in terms of level and type of pollutants, with purification facilities.

The comprehensive electroflotation method developed by Ufa scientists promises a tremendous national-economic, sanitation and ecological impact. It permits not only rendering waste discharges harmless, but also returning millions of tons of petroleum products, hydrocarbon fractions, proteins and other organic compounds for use in the national economy.

But if the advantages and benefits of electroflotation are so obvious, why has this method not gone beyond the framework of experimental industrial tests? Why has it not been introduced extensively into production?

There seem to be no clear opponents of the new method: the advantages of the Ufa developments are, after all, quite clear. But as often happens, the inertia of economic leaders has gained the upper hand, abetted by the undemandingness of workers in the sanitation and water inspectorates. Were these inspectorates not to close their eyes, let's say, to the turbid waste water disgorged by the plants and separator centers of Bashkiria, V. Loshak, the Director of the "Bashmoloko" association could hardly limit himself just to signing a document certifying that electroflotation has been laboratory tested for purifying sample discharges of the Ufa Dairy. He would try to provide subordinate enterprises with these installations as quickly as possible. At the same time, the association's chief engineer, G. Ashirov, states that he has little faith in the effectiveness of this method and so there is no need to force industrial electroflotation testing at "Bashmoloko" enterprises. By the way, leaders of the Ufa Motor Vehicle Center of the VAZ are of a different opinion. In cooperation with institute workers, they are

installing on their own a facility which will enable them to fully purify waste water and use it in the return water supply.

"We are assembling in the laboratory attached to our department single experimental installations of this type," says Professor I. L. Markhasin. "And we could produce considerably more were we permitted to add to our staff several fitters and electricians and were the laboratory to be provided with materials and additional equipment. It would be appropriate to create at the institute an experimental production facility to manufacture electroflotation devices, at least initially for enterprises of the Bashkiria region, and also to set up a service to adjust the devices and develop optimum purification technology as applicable to the specifics of individual facilities."

Whether or not the little streams feeding the mighty rivers and lakes will always be sky-blue and clean will depend on how quickly the new method finds a broad path into production.

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ZAPOROZH'YE WASTE TREATMENT EFFORTS

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 3 Sep 80 p 2

[Article by Yu. Sushko: "Revenues From Flues"]

[Text] You could just wade this stream if you wanted to. But there are not many who would want to. The water's color, red, scares them off. That's what named this river-maker flowing through the heart of Zaporozh'ye. We know the stream starts in the shops of the metallurgical giants.

In times past, waste-water discharges passed through a settling tank en route to the Dnepr'. Since that accumulator of substances harmful to the Dnepr' exhausted its capacity, that is, since the bottom became level with the banks, a new settling tank has been put into operation. According to the planners' calculations, it must do for about 20 years.

It turns out that the planners did not consider the fact that the capacities of the enterprises will increase year by year and that the red river will be growing along with them. In brief, the accumulator in Kapustyanaya Ravine will fill with solid wastes faster than expected. But there is nowhere to put another one. And the plants can't be stopped. What will happen? They have taken a very easy course: the polluted water, with its impurities, is cutting a channel straight for the Dnepr'.

The situation has caused alarm. So "Vodokanalproyekt" engineers quickly drew up a new plan to rescue the Dnepr' from pollution. It would seem we can breathe easier. But then it is quickly revealed that the first line of the complex will not be able to handle the growing waste discharge flow. A second line is needed. And that facility is put into operation, with considerable delay. Right after it begins operating, the amount of suspended substances reaching the river is cut 10-fold.

State water inspectorate chief Ruslan Kizym shows me two test tubes. In one is a 1979 water sample (that is, from before the new facility began operating), and in the other is a sample from this summer. The first is dark brown, the second is only slightly rust-colored. Unquestionably something, but still not enough.

"This is a temporary victory," says R. Kizym. "In fact, in spite of all the equipment available, and that complex of equipment is at last complete, the polluted water is again reaching the Dnepr'."

Each of the 10 open-hearth furances of the "Zaporozhstal'" "exhales" approximately 100,000 m^3 of gas per hour. Tiny particles of slime also rise into the sky along with it.

"We are protecting the air and the Dnepr'," says I. I. Martynyuk, an open-hearth shop scrubber sector foreman. "That is why our installations, like the open-hearth furnaces, operate around the clock, uninterrupted, saving our river about a thousand cubic meters of clean water. The water courses through the return-cycle system like a squirrel in a cage [i.e., fast, but doing nothing]."

Powerful exhaust fans pull all the furnace smoke into a turbulent scrubber, a Venturi tube. Here, an artificial rain washes the slime out of it. Finally, dust extractors use water to remove the solid particles and the water is returned to its place in the scrubber. All well and good, but not enough.

Many organizations are engaged in the noble cause of protecting the environment in the city. They are doing quite a bit to ensure that both the water in the river and the air will always be clean. We might cite the institute branches, the "NIIOgaz," the "Giprogazoochistka," the department of environmental protection economic problems of the Ukrainian SSR Academy of Science's Institute of Industrial Economics, the ecology department at Zaporozh'ye Industrial Institute, and the public environmental protection and production ecologization laboratory headed by engineer A. V. Nagornyy.

"People mine raw material, use it, and discard what they do not need into either the air or the water. Don't you wonder how much of the raw material we use?" asks Aleksey Vasil'yevich. And he tells us: "Alas, only three percent. The other 97 percent is returned to the environment, polluting it. The future of our industry lies in creating waste-free technology. In other words, we must operate under the slogan 'Revenue From Refuse'. Our laboratory has been engaged for several years now in developing plans for a combine to collect and process gas-dust waste and household refuse. And we have managed to close the circle of 'raw material - item - waste - raw material', thus repeating in miniature the natural circulation of substances in the biosphere...."

In fact, "Revenue From Refuse" does sound good, especially when it is backed up by convincing proof. The slime washed out of the open-hearth furnace gas is suitable for use in blast furnaces and for manufacturing linoleum and rubber. Vulcanized rubber can obtained from steel-smelting production waste. And that's not just what can be done; it is already being done. The problem of protecting the environment is important, just as nature is important. And the path proposed by the Nagornyy laboratory is one of many decisions which will enable us to use thriftily the riches surrounding us. The laboratory's production ecologization plans will doubtless be carried out, but it will take everyone's help.

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